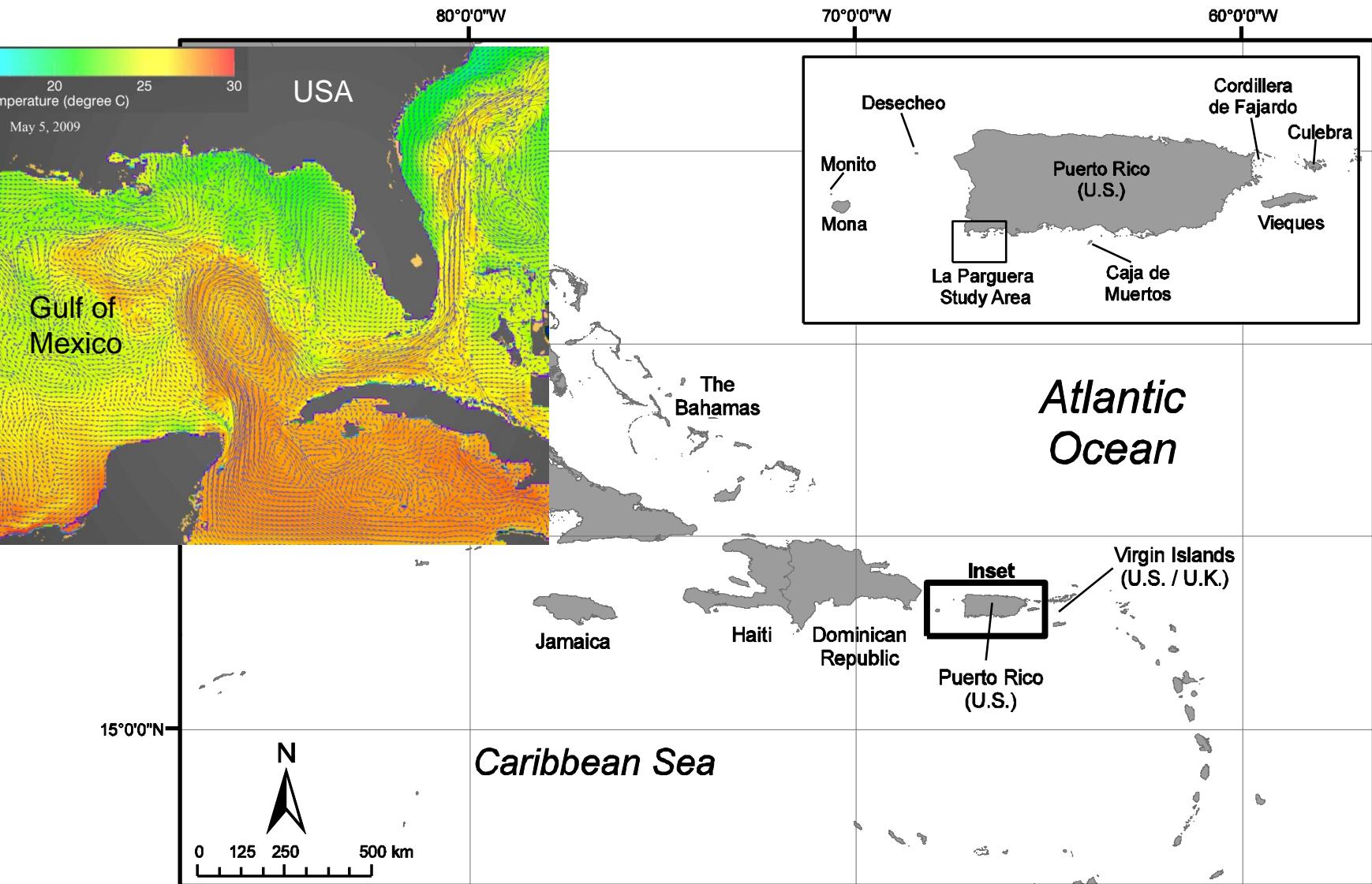
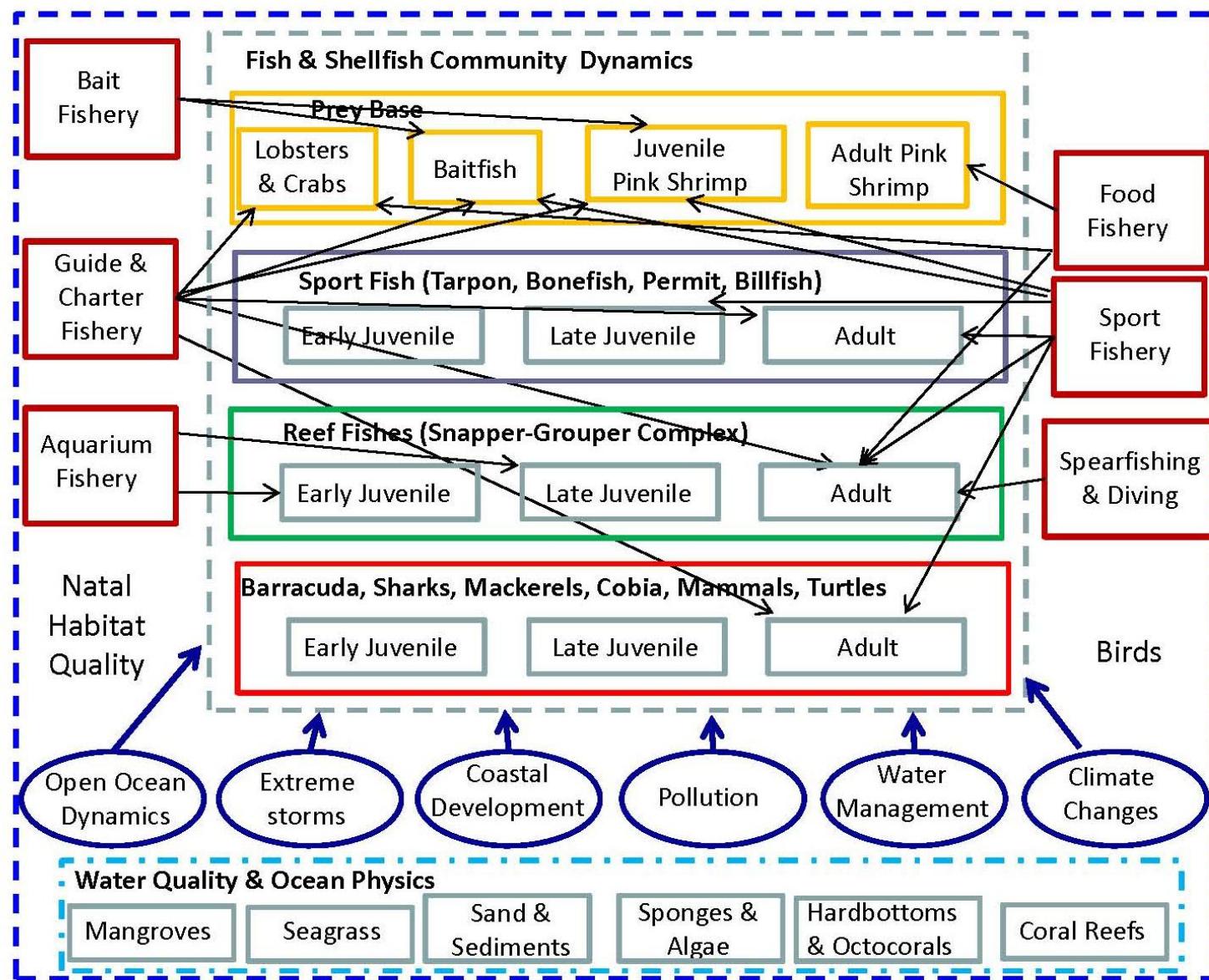


Southern Florida Reef Fish Visual Survey

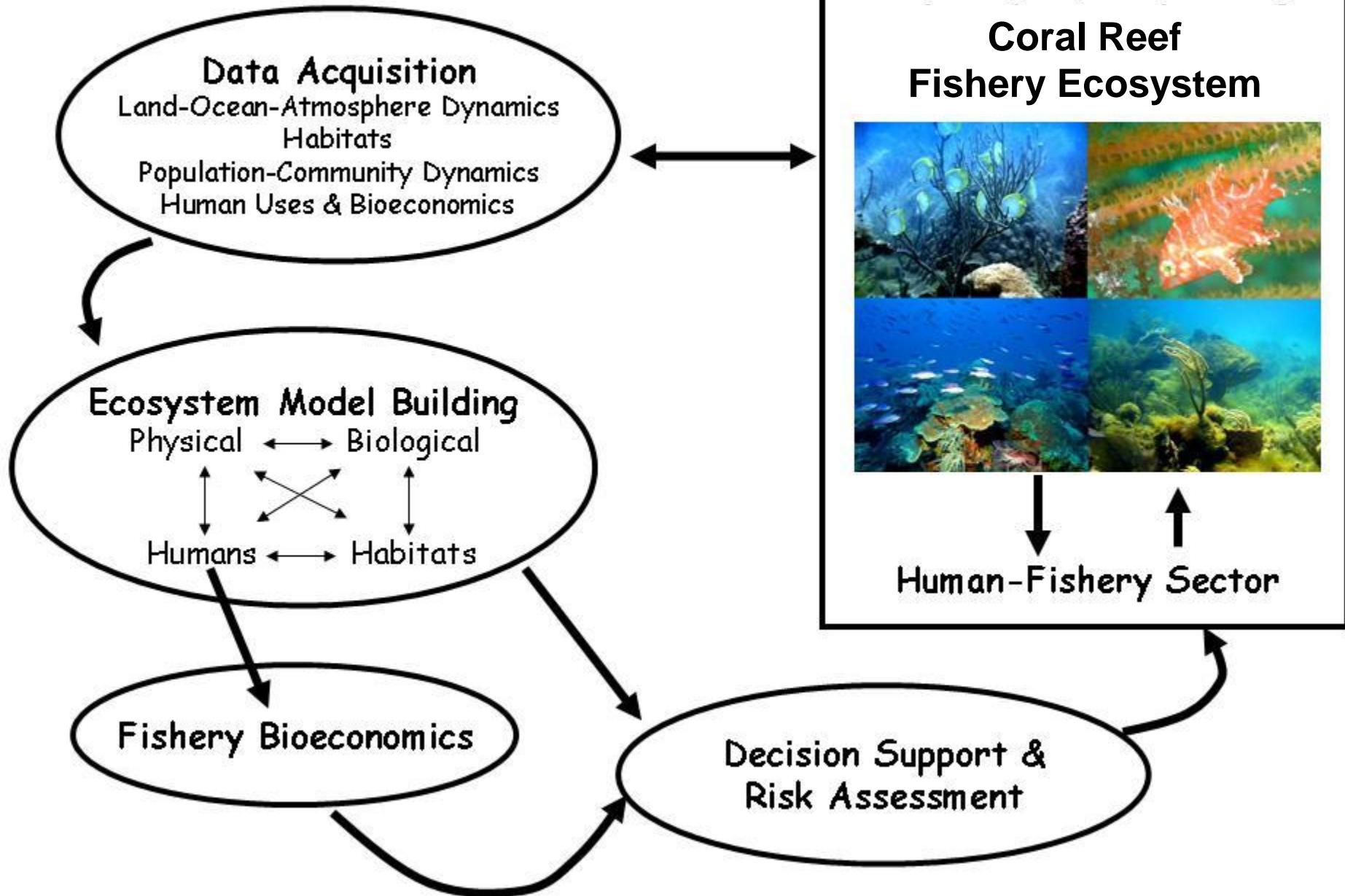
Jerald S. Ault, Steven G. Smith, James A. Bohnsack



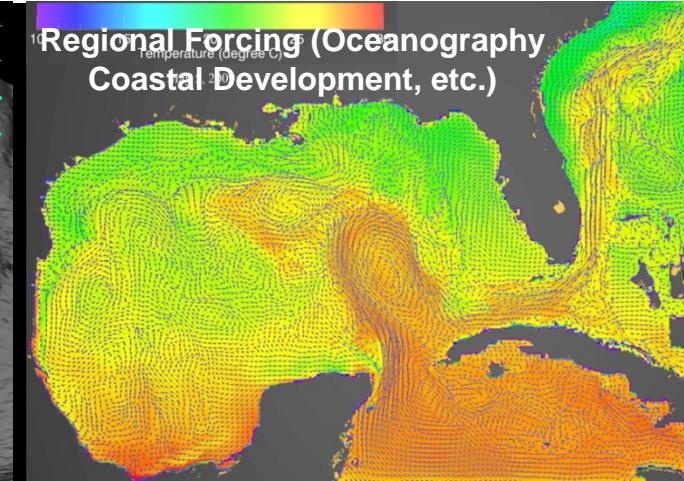
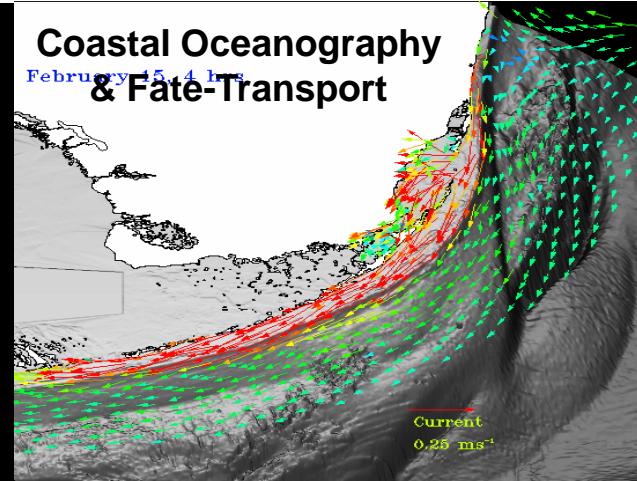
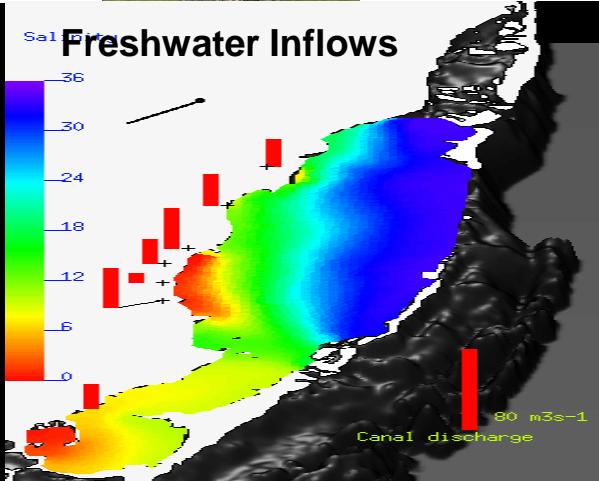
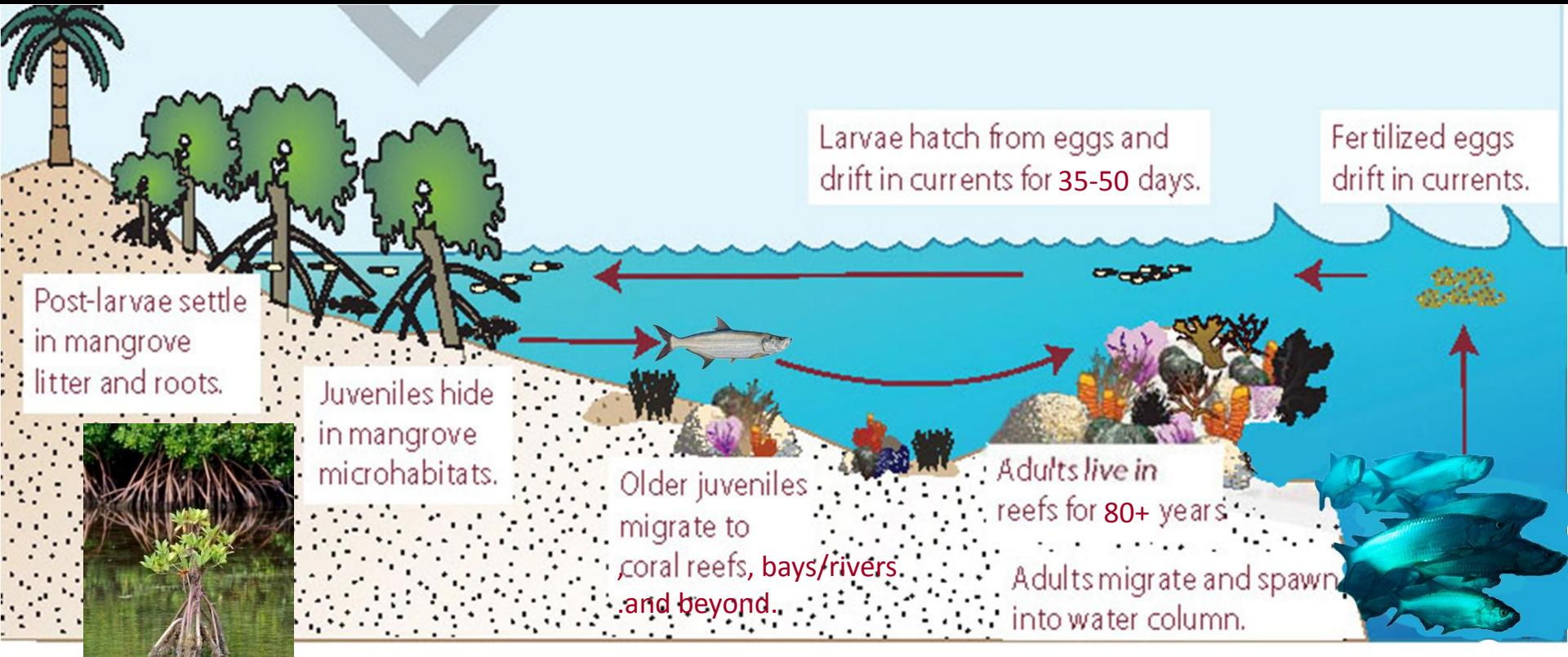
Ecological and fishery dynamics of southern Florida



Coral Reef Eco-“Systems Science”



Coastal Oceanography & “Habitat” Use Ontogeny



New Data Paradigm Required

Fish Community Assessment

- Exploited and Non-Target Species
- Trophodynamic Levels (Predator-Prey)
- Full Size Spectrum (Recruits, Adults, Exploited)

Spatial Dynamics

- Inside-Outside MPAs
- Habitat Use Patterns/Movement Strategies

Fishery-Dependent Data Largely Inadequate

Goal of Fishery-Independent Surveys:

Estimate population & community metrics --
Accurate, precise, and cost-effective

Relationship between Reef-fish Visual Census and Data Needs of Stock Assessment

Average Population Size

$$\bar{N} = \frac{N_0}{(M + F)} (1 - S)$$

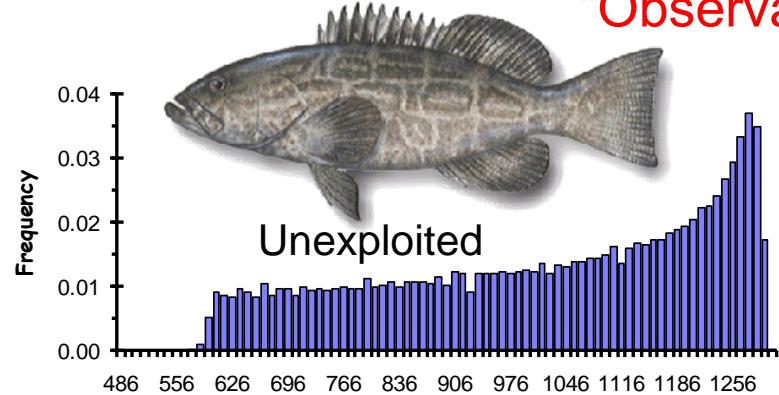
Baranov Catch Equation

$$C = Y_N = F\bar{N} = EN_0 = N_0 \left(\frac{F}{(M + F)} \right) (1 - e^{-(M+F)})$$

Diver Sighting (Catch) Equation (with negligible selectivity in exploited phase)

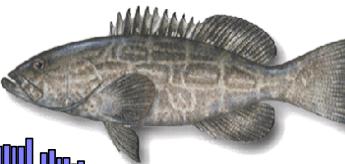
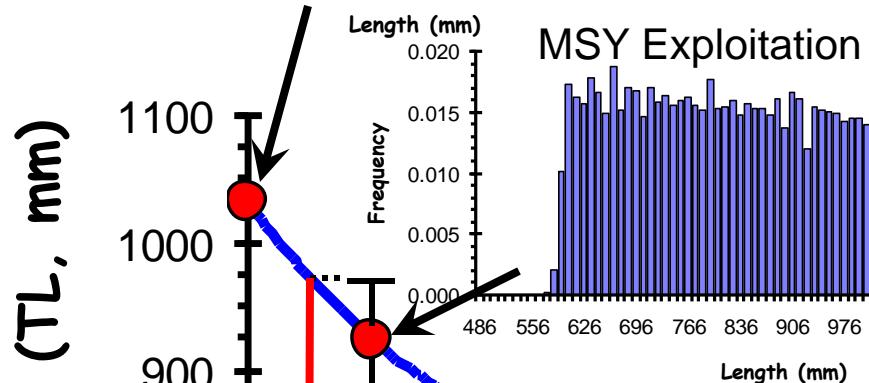
$$\frac{Y_N}{f} = q \left(\frac{N_0}{(M + F)} \right) (1 - e^{-(M+F)})$$

“Observable” Assessment Indicator Variables

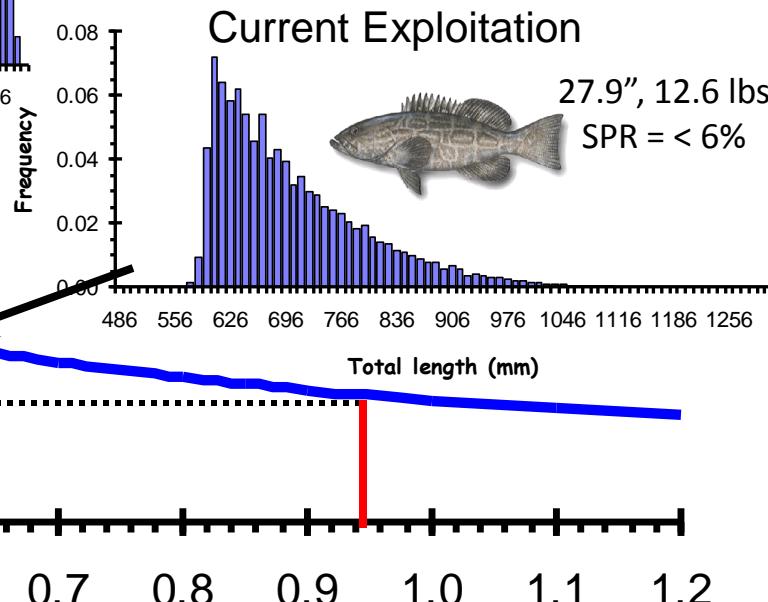


40.6", 42.8 lbs
SPR = 100%

$$\bar{L}(t) = \frac{\int_{a_c}^{a_\lambda} F(t) N(a,t) L(a,t) da}{\int_{a_c}^{a_\lambda} F(t) N(a,t) da}$$



36.4", 30.1 lbs
SPR = 35.1%



27.9", 12.6 lbs
SPR = < 6%

Minimum Legal Size
(24 inches)

Fishing Mortality Rate

Limit-Control Rule Indicator

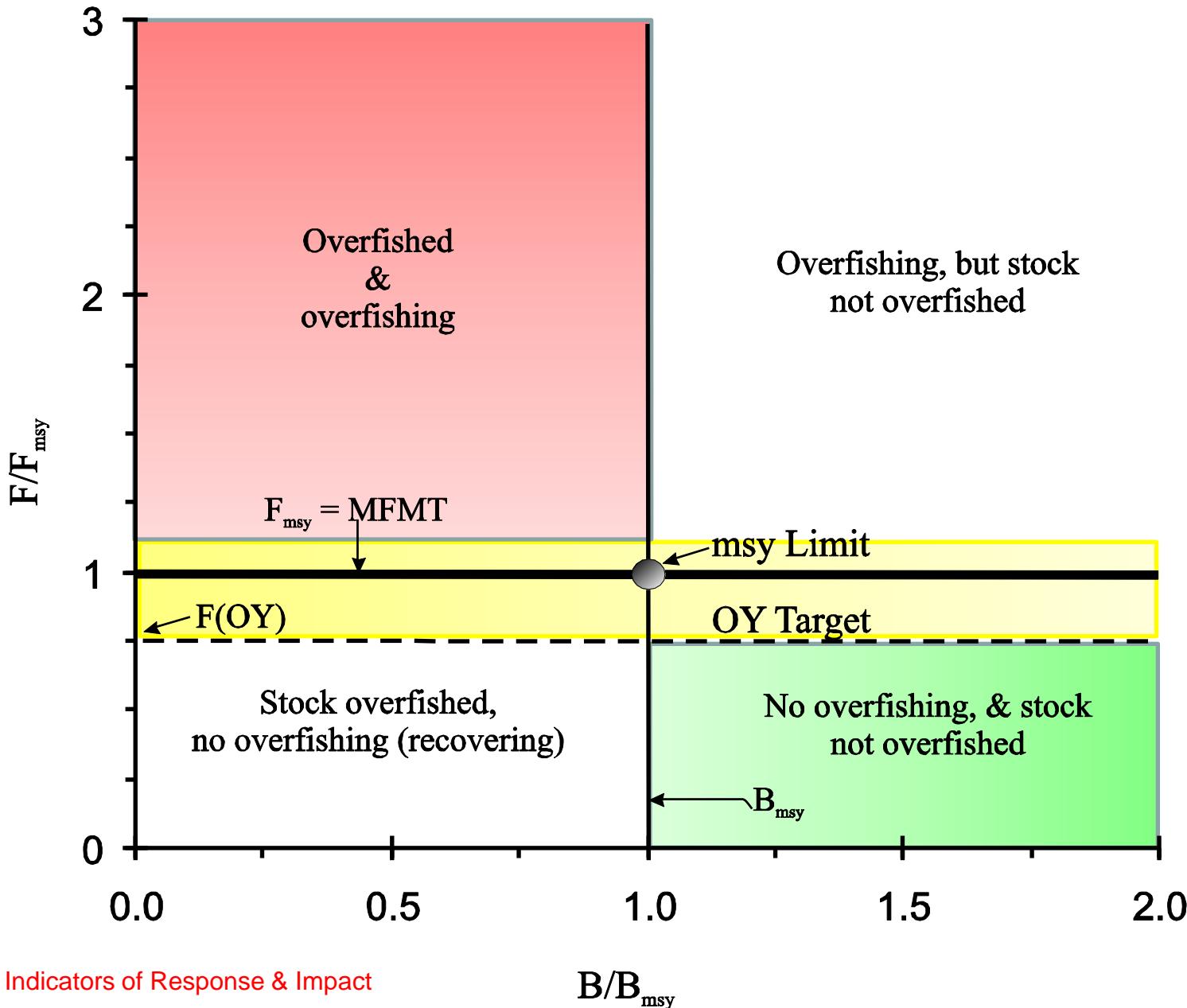
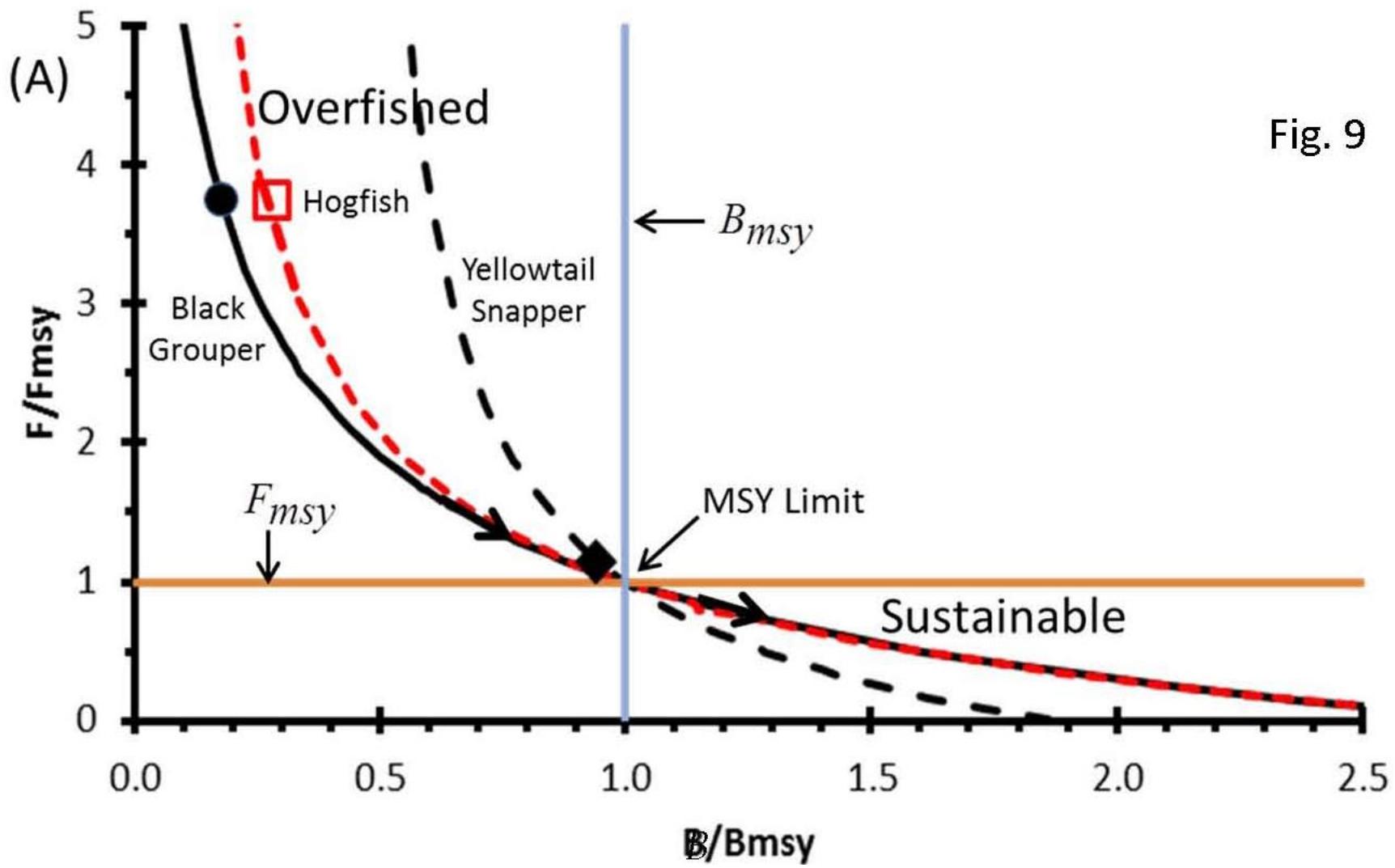
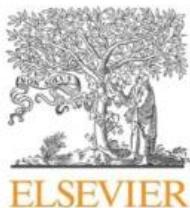


Fig. 9





Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres



Multispecies survey design for assessing reef-fish stocks, spatially explicit management performance, and ecosystem condition

Steven G. Smith^{a,*}, Jerald S. Ault^a, James A. Bohnsack^b, Douglas E. Harper^b,
Jiangang Luo^a, David B. McClellan^b

^a University of Miami, Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, FL 33149, USA

^b NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149, USA



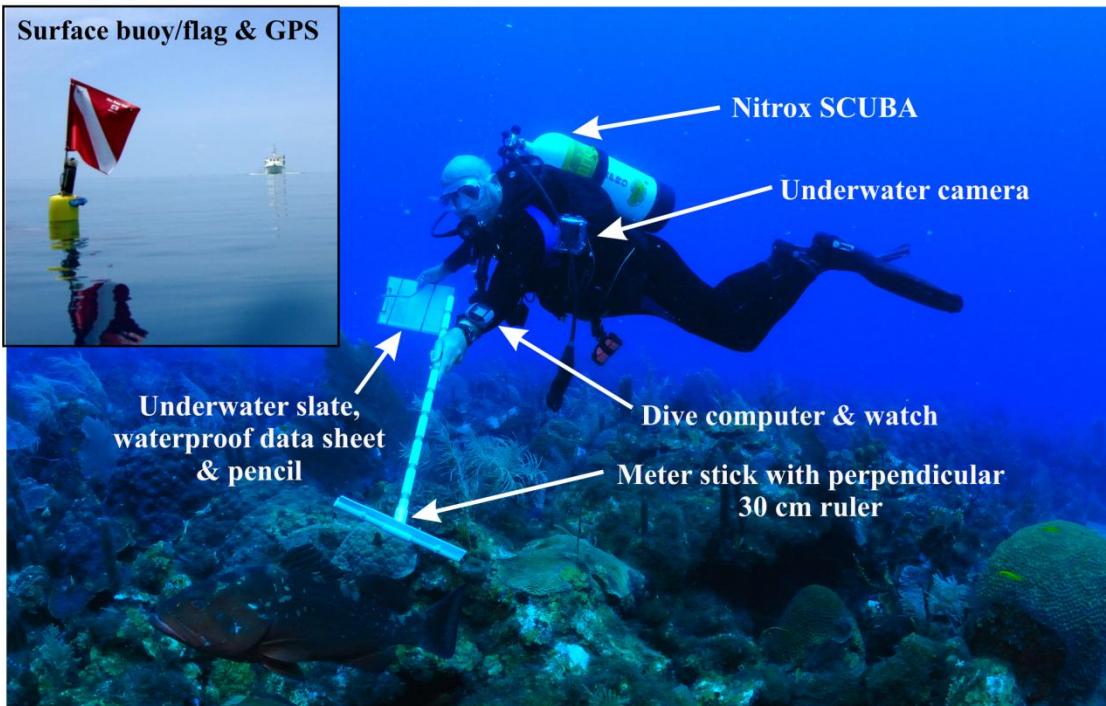
A Cooperative Multi-agency Reef Fish Monitoring Protocol for the Florida Keys Coral Reef Ecosystem

Natural Resource Report NPS/SFCN/NRR—2009/150

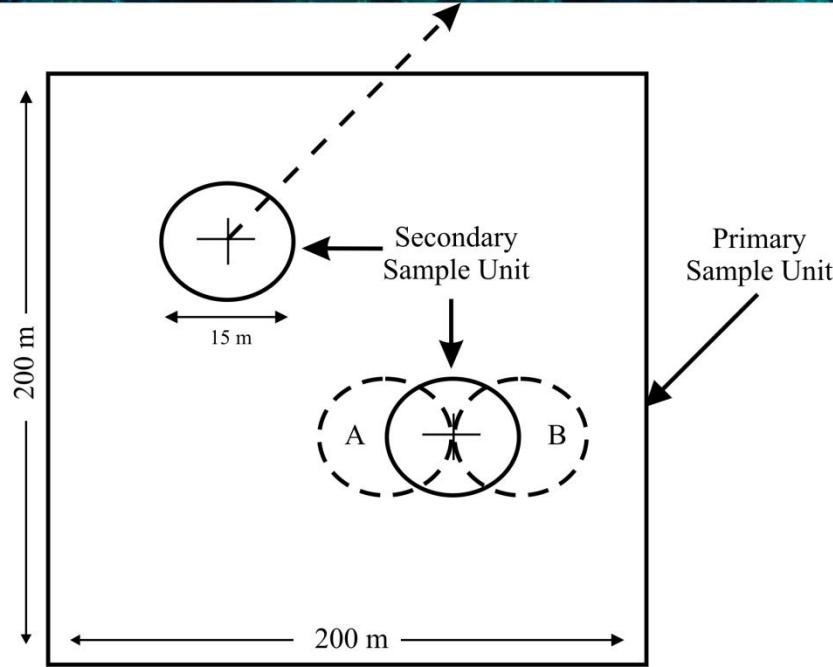


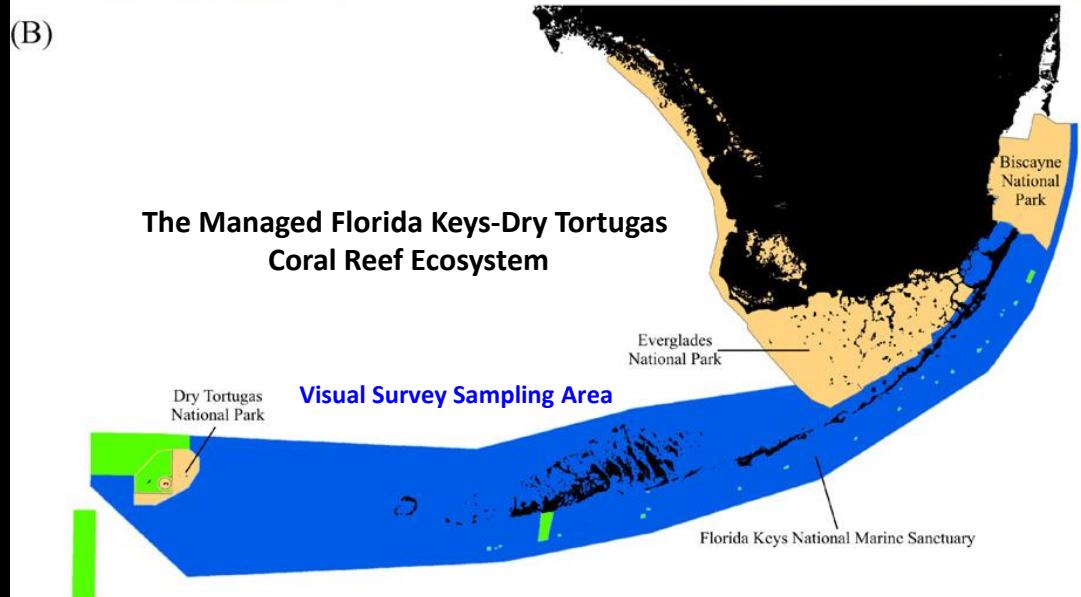
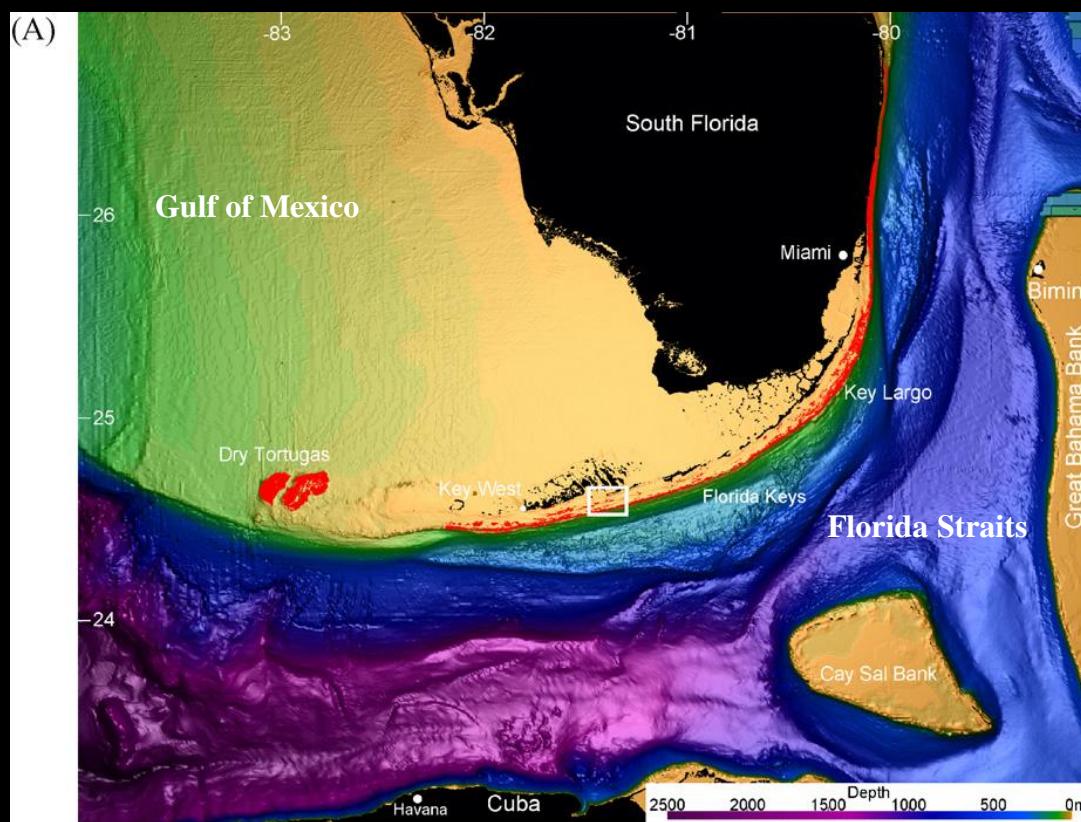
Figure 2

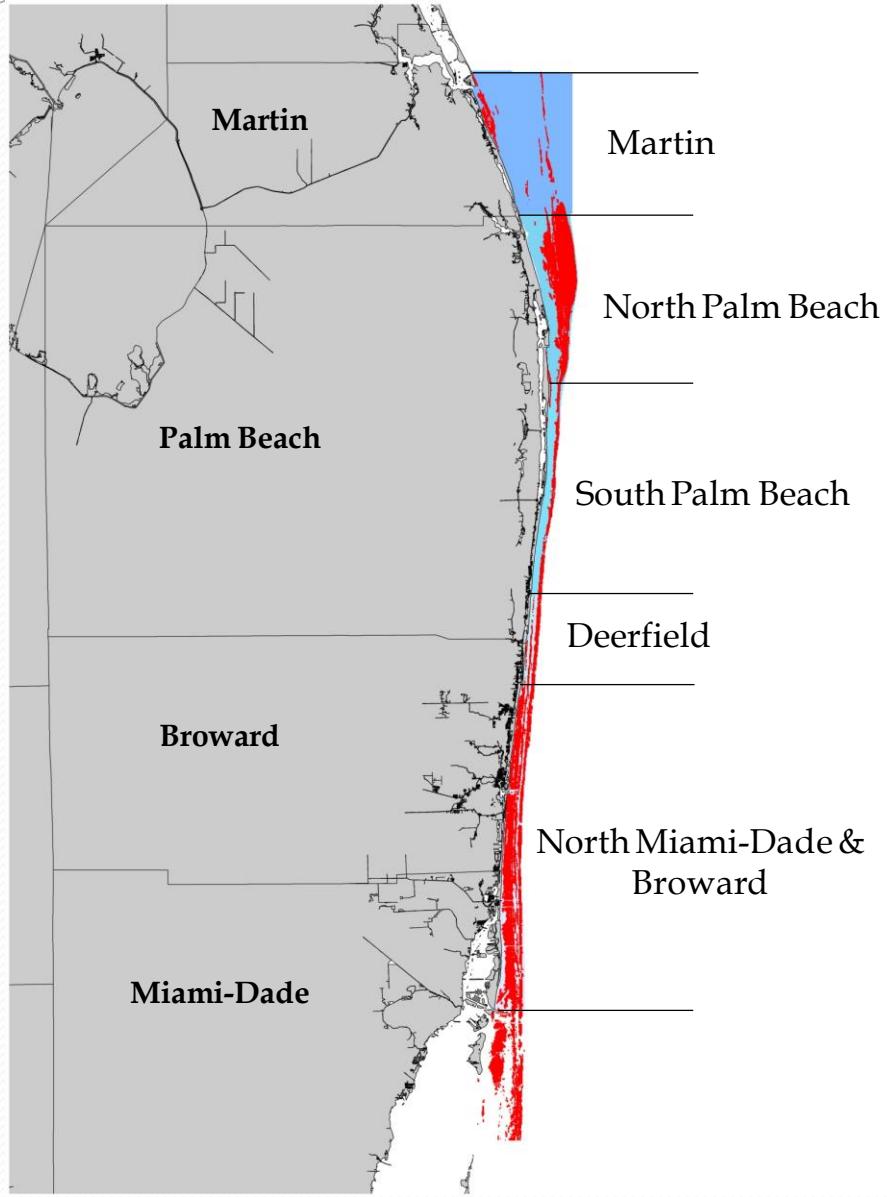
(A)



(B)







SEFCRI Region

Precise, Cost-Effective Survey Designs

Stratification Scheme

Partitions survey domain into subregions of low, moderate, and high variance

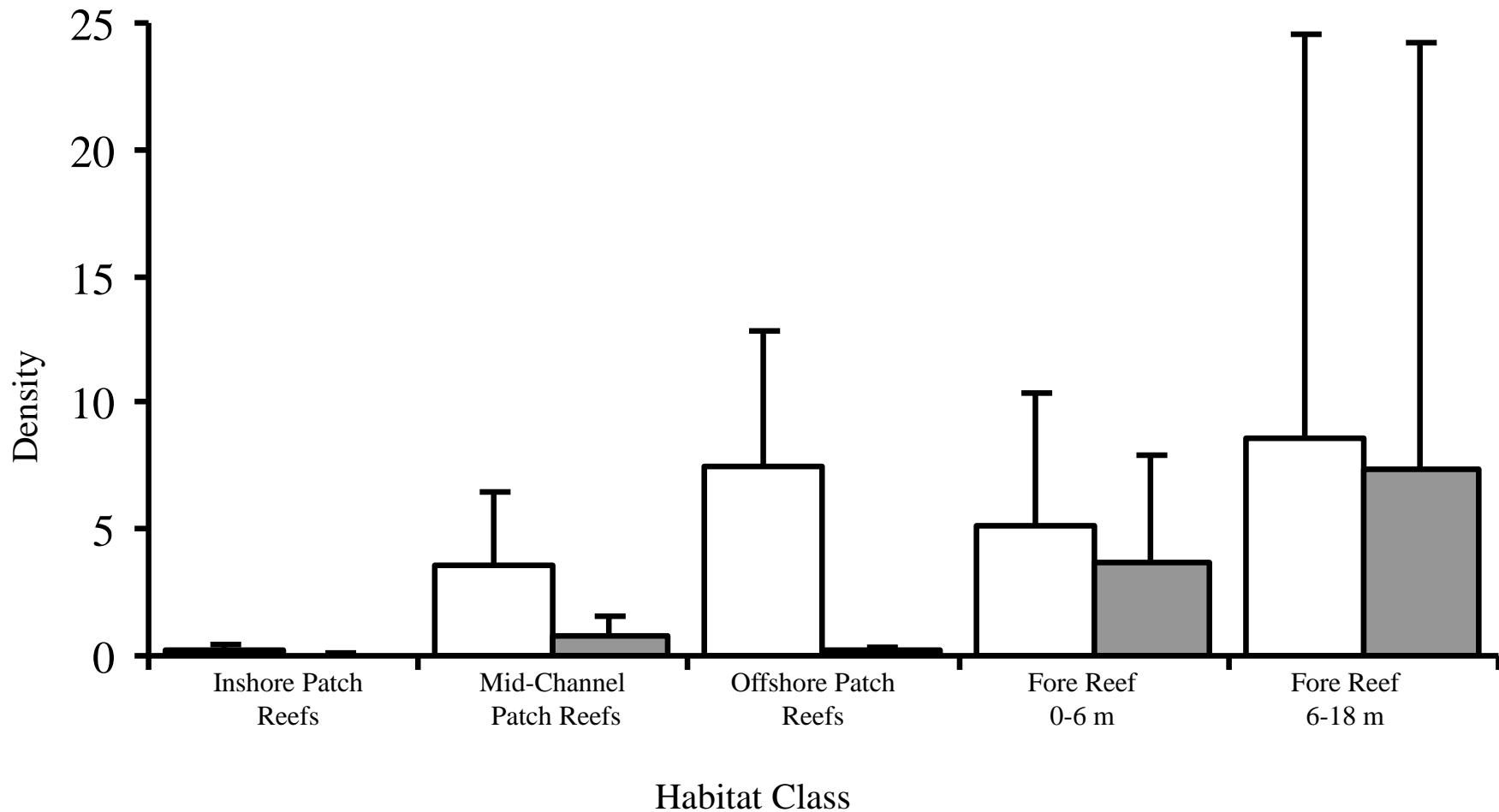
Allocation Scheme

Allocation based on stratum size and variance

More samples in larger strata

More samples in higher variance strata

Yellowtail Snapper, Juveniles and Adults



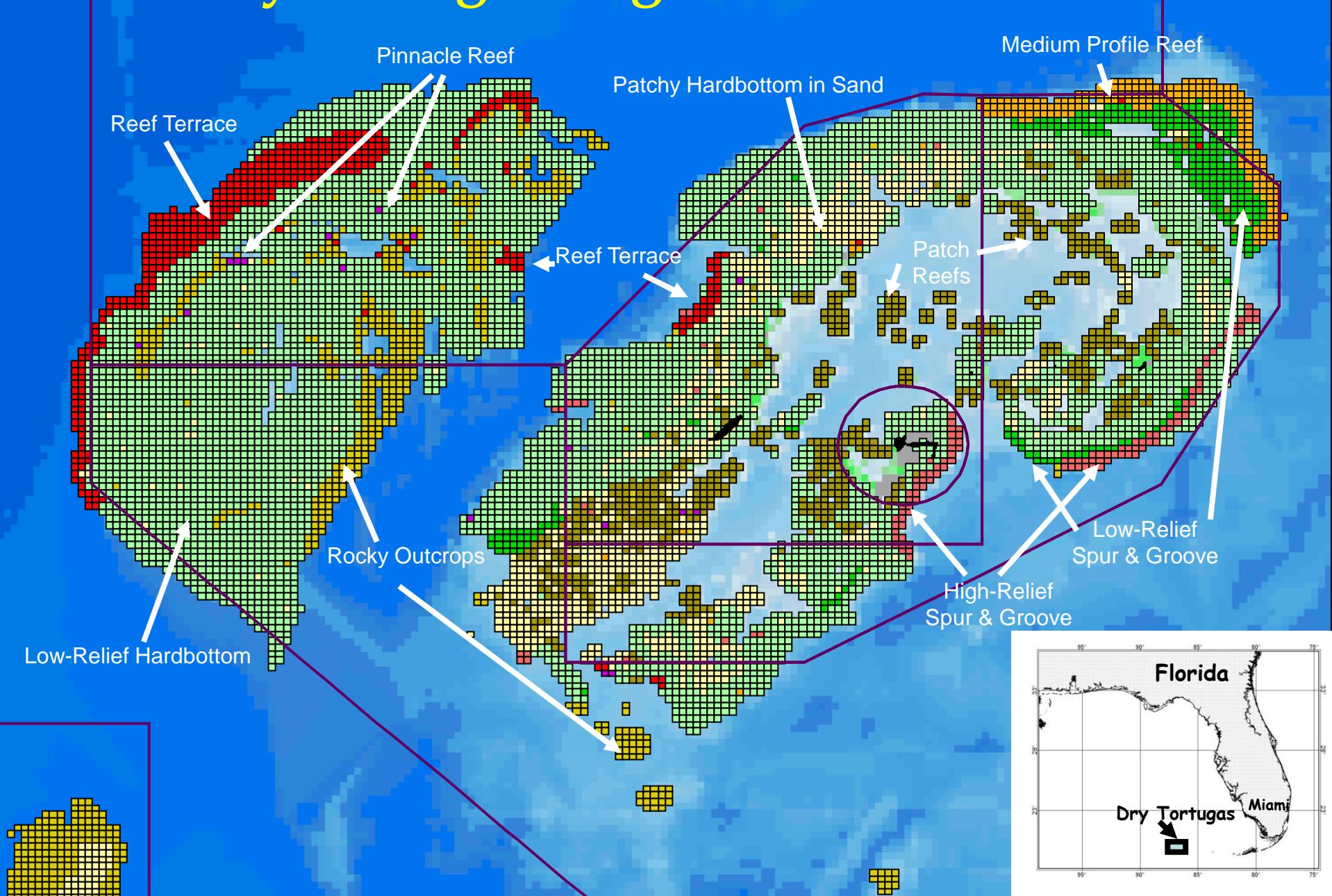


Gray Snapper

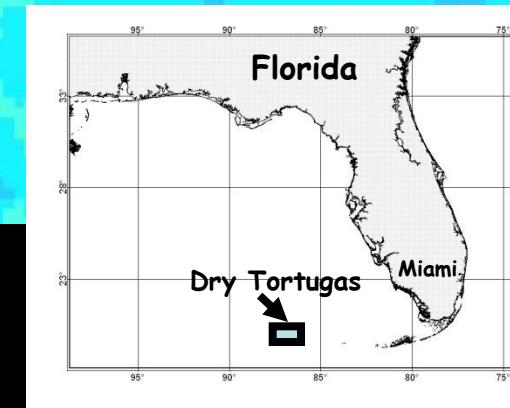
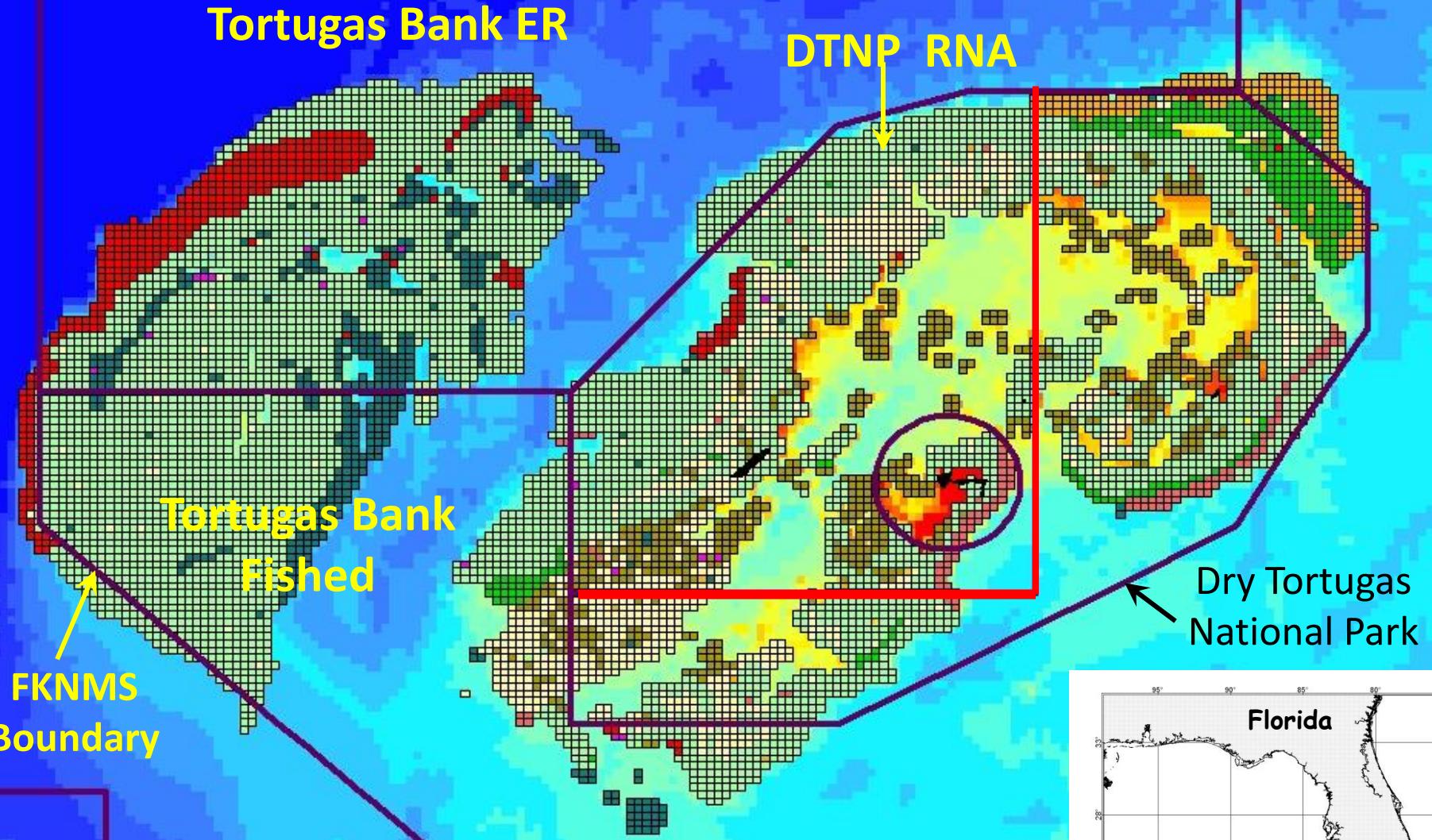


Length (cm)

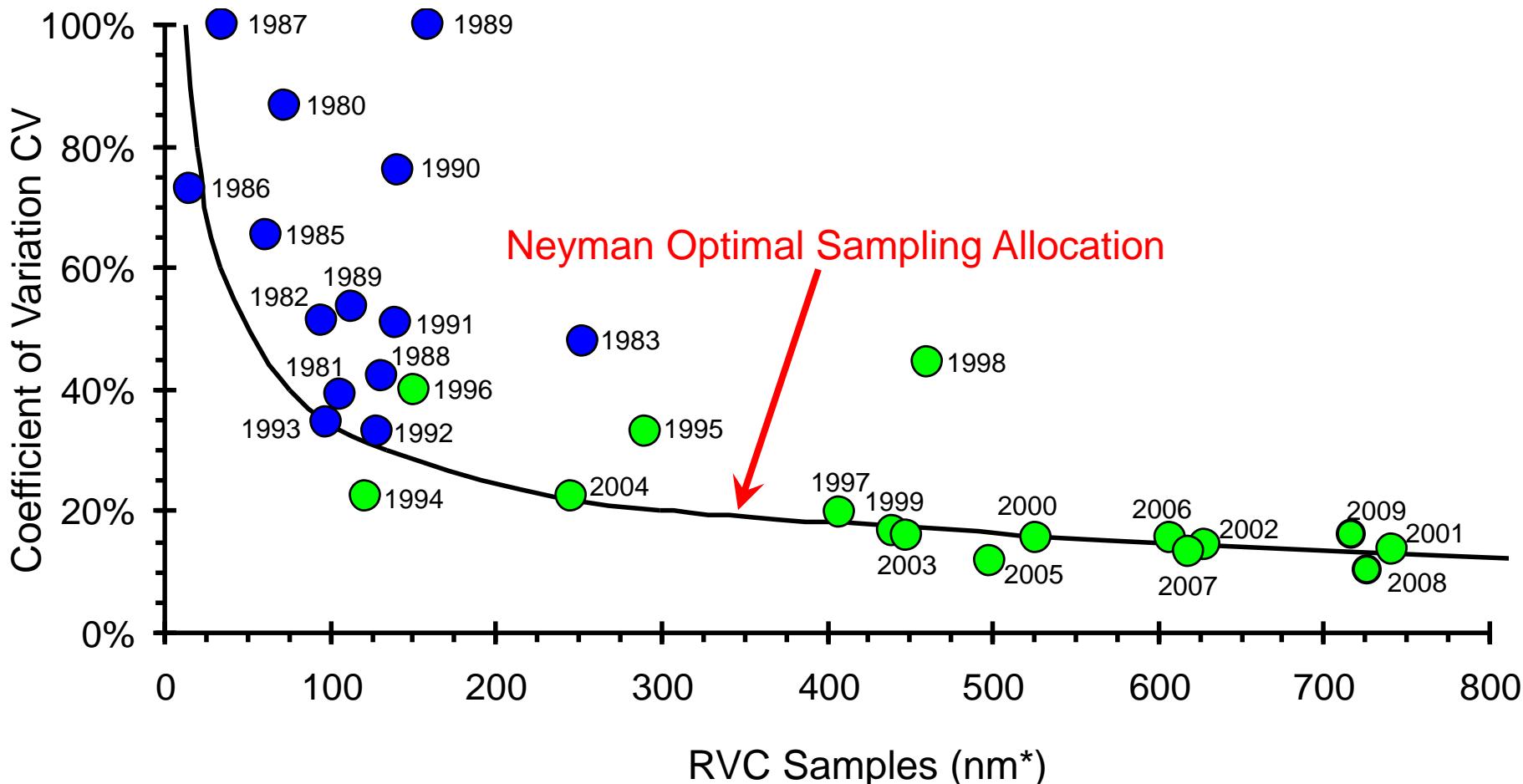
Dry Tortugas Region Reef Habitats

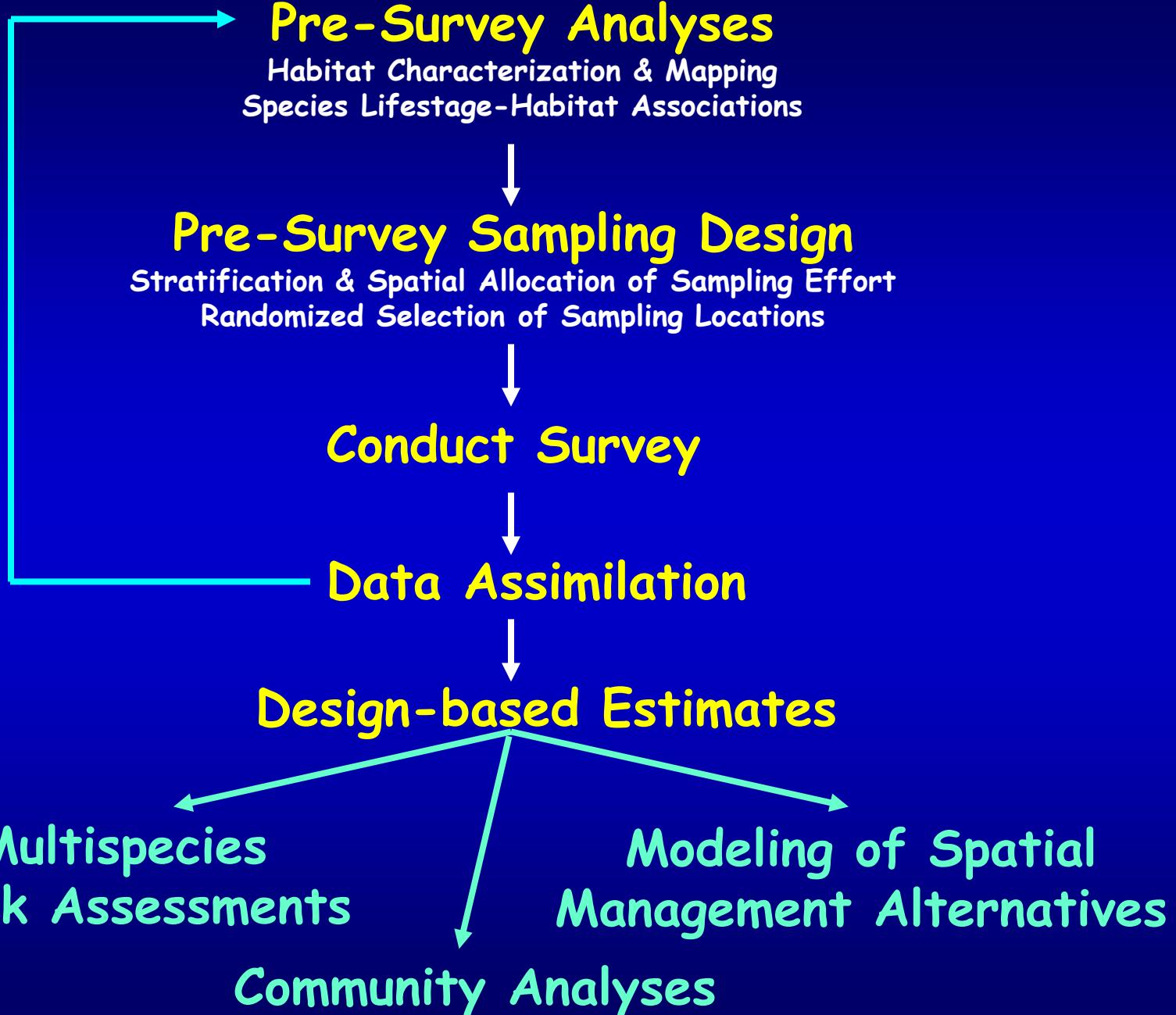


Tortugas Region Management Boundaries

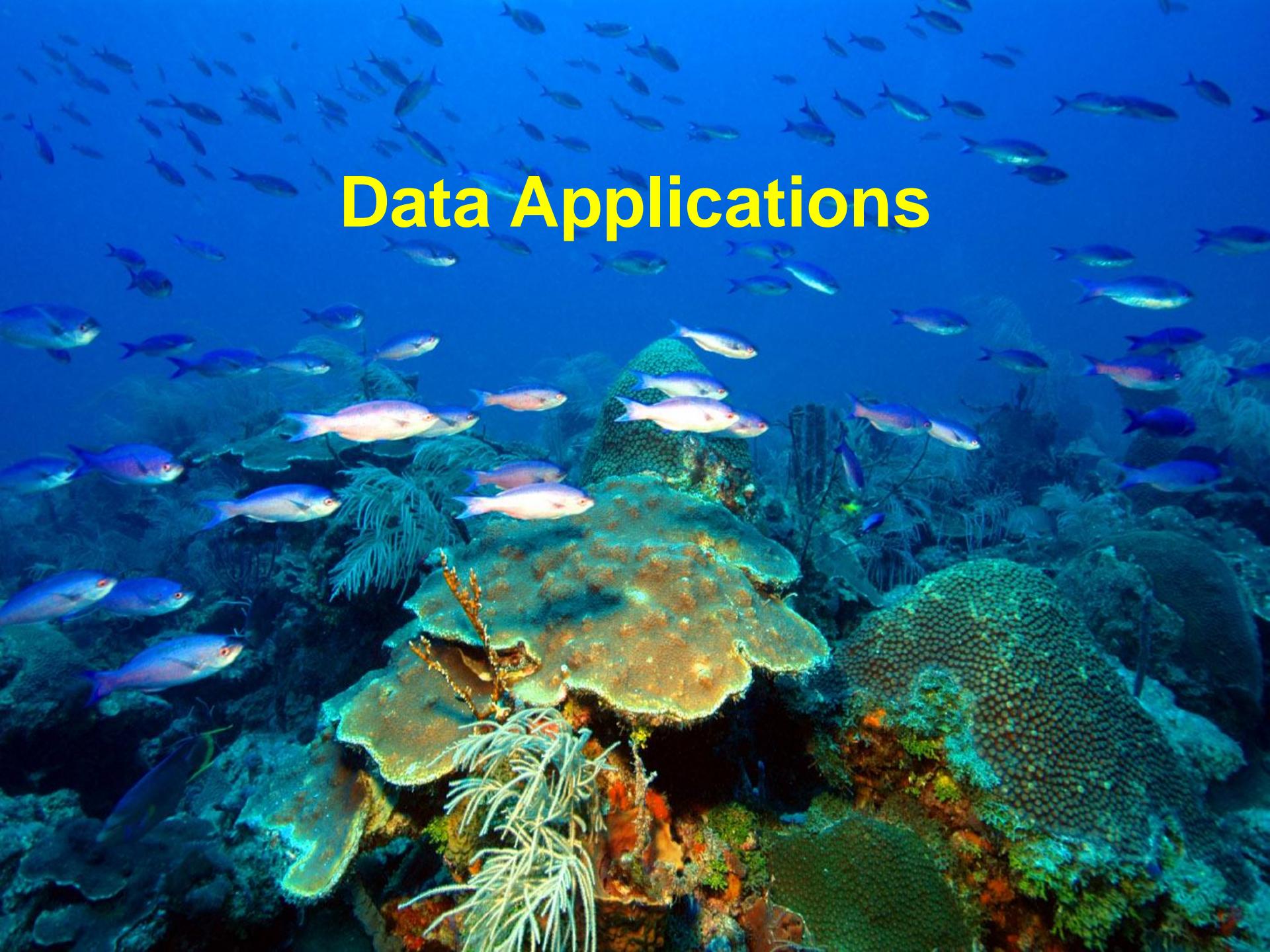


Florida Keys Sampling Design Efficiency 1979-2010





Data Applications



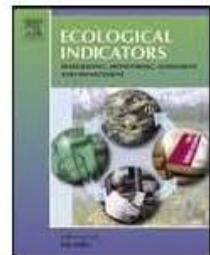
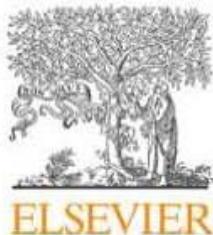
Fishery-Dependent & Fishery Independent Data Sources

Primary

Source	Database	Metrics	Spatial Resolution
Commercial Fleet	Florida Trip-Ticket	Catch-per-unit-effort and size structured abundance	Florida-wide, but particularly focused on southwest and southern Florida
	Trip Interview Program	Catch length composition	Florida-wide, but particularly focused on southwest and southern Florida
Recreational Fleet	MRFSS/MRIP	Catch-per-unit-effort, and size structured abundance	Florida-wide, but particularly focused on southwest and southern Florida
Fishery-Independent	Reef Fish Visual Census (<35 m)	Size-structured abundance	Southern Florida, Florida Keys & Dry Tortugas
	NMFS Bottom Longline	Size-structured abundance	Florida-wide, but particularly focused on southwest and southern Florida
	Reef Fish ROV and Drop Camera Surveys (>35m)	Size-structured abundance	Pulley Ridge, Madison-Swanson reserve, W. FL Shelf

Secondary

Source	Database	Data Types	Spatial Resolution
Recreational Fleet	Headboat Survey	Length compositions	Florida-wide, but particularly focused on southwest and southern Florida
	NPS Creel Survey	Catch-per-unit-effort, and size structured abundance	Biscayne National Park
	NPS Creel Survey	Catch-per-unit-effort, and size structured abundance	Dry Tortugas National Park



Indicators for assessing the ecological dynamics and sustainability of southern Florida's coral reef and coastal fisheries



J.S. Ault^{a,*}, S.G. Smith^a, J.A. Browder^b, W. Nuttle^c, E.C. Franklin^d, J. Luo^a, G.T. DiNardo^e,
J.A. Bohnsack^b

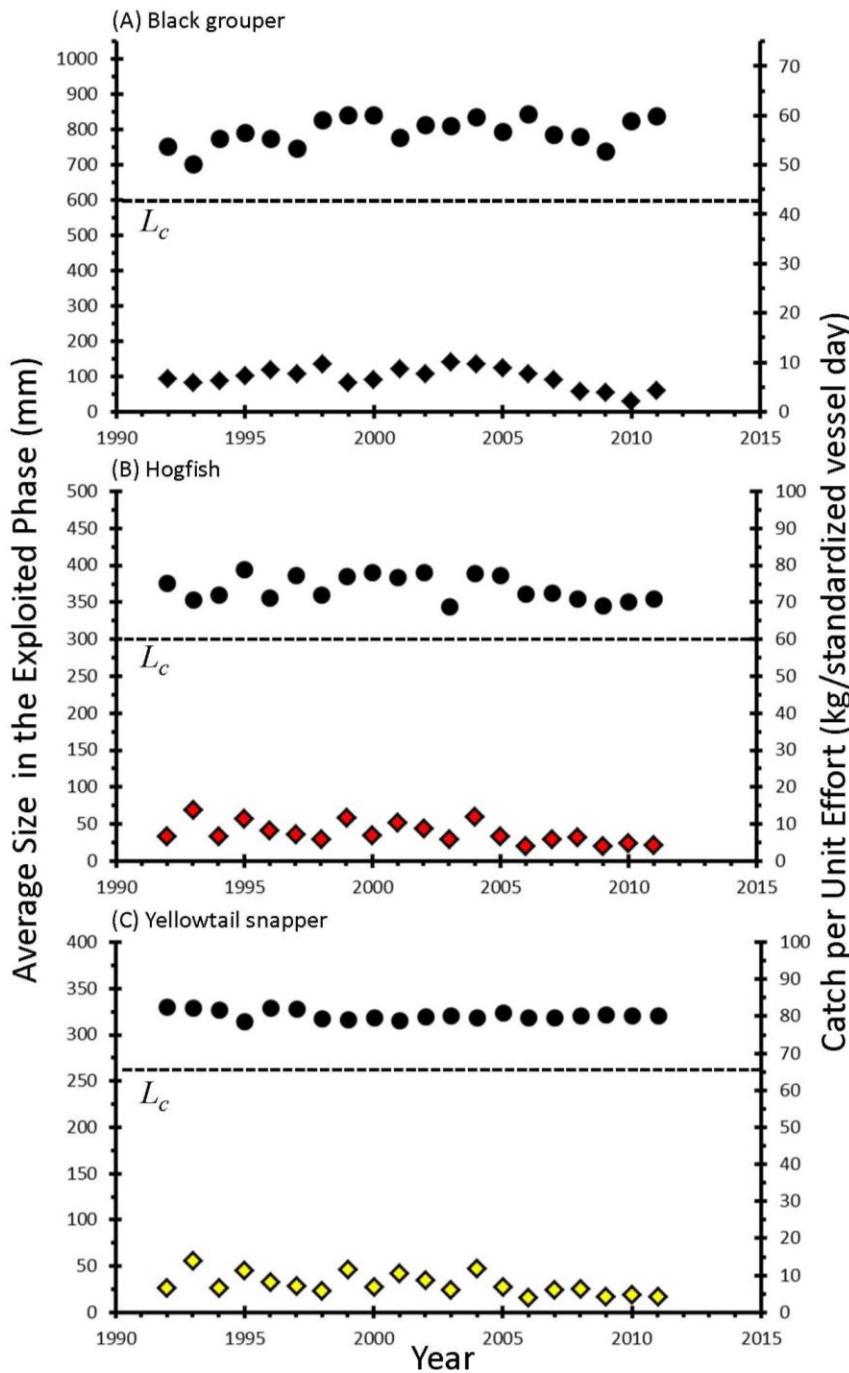
^a University of Miami, Rosenstiel School of Marine and Atmospheric Science, Miami, FL 33149, USA

^b National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL 33149, USA

^c Eco-hydrology.com, Ottawa, ON K1B4G6, Canada

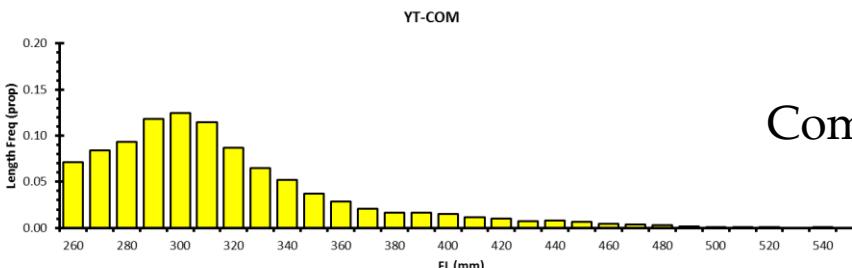
^d University of Hawai'i at Manoa, School of Ocean and Earth Science and Technology, Hawai'i Institute of Marine Biology, Kaneohe, HI 96744, USA

^e National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Honolulu, HI 96822, USA

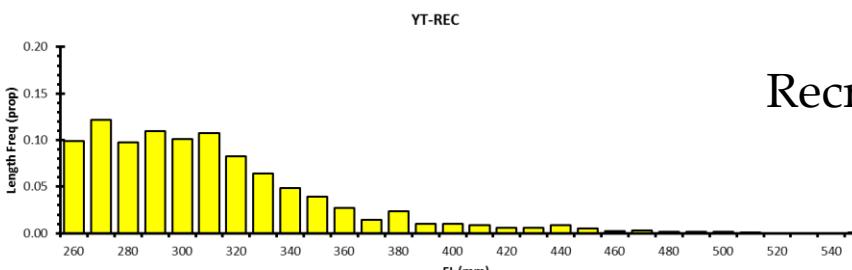


Standardization of Size-Structured Abundance Among Fleets

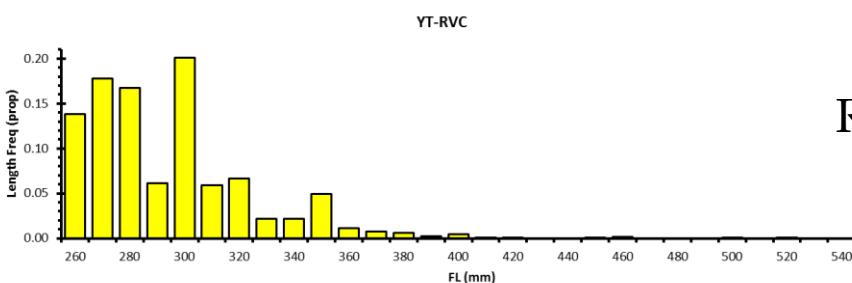
(A) Empirical length frequencies



Commercial

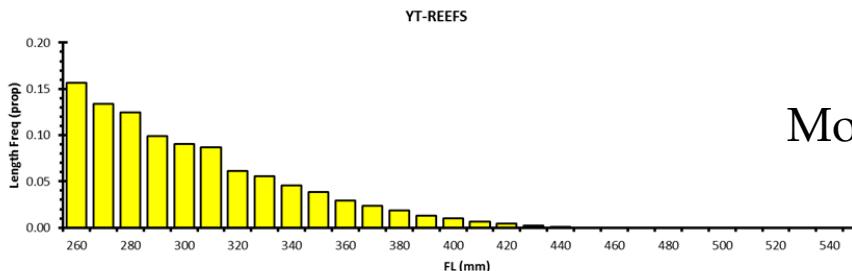


Recreational



RVC

(B) Model-predicted length frequency at estimate $F=0.38$.



Modeled

Evaluation of average length as an estimator of exploitation status for the Florida coral-reef fish community

Jerald S. Ault, Steven G. Smith, and James A. Bohnsack

Ault, J. S., Smith, S. G., and Bohnsack, J. A. 2005. Evaluation of average length as an estimator of exploitation status for the Florida coral-reef fish community. — ICES Journal of Marine Science, 62: 417–423.

A retrospective (1979–1996) multispecies assessment of coral reef fish stocks in the Florida Keys

Jerald S. Ault

Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway, Miami, Florida 33149
E-mail address: ault@shark.rsmas.miami.edu

James A. Bohnsack

Southeast Fisheries Science Center
National Marine Fisheries Service, NOAA
75 Virginia Beach Drive, Miami, Florida 33149

Geoffrey A. Meester

Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway, Miami, Florida 33149

**Manuscript accepted 16 December 1997.
Fishery Bulletin 96(3):395–414 (1998).**

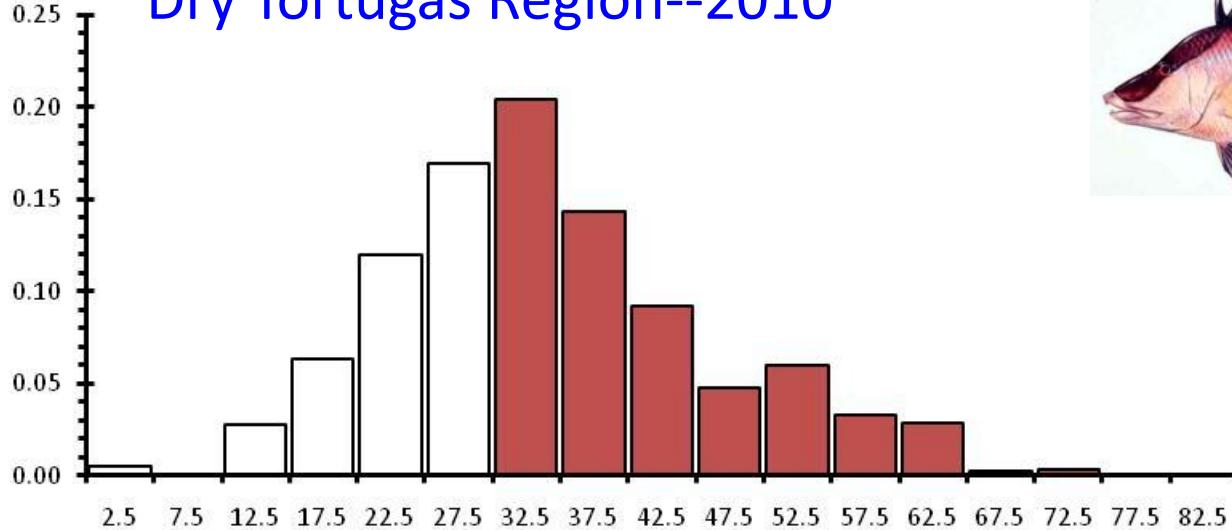
Length-based assessment of sustainability benchmarks for coral reef fishes in Puerto Rico

JERALD S. AULT^{*,1}, STEVEN G. SMITH¹, JIANGANG LUO¹, MARK E. MONACO² AND RICHARD S. APPELDOORN³

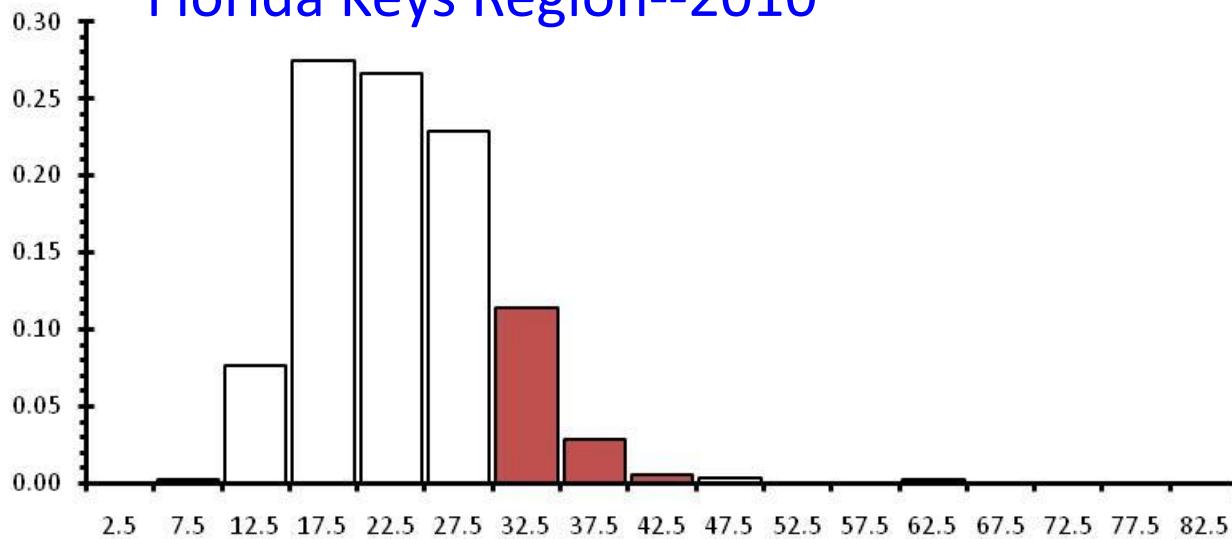
¹University of Miami, Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, Florida 33149, USA ²NOAA National Ocean Service Biogeography Branch, 1305 East West Highway, Silver Spring, Maryland 20910, USA ³University of Puerto Rico, Department of Marine Sciences, Mayaguez, Puerto Rico USA

Date submitted: 17 December 2007; Date accepted: 3 September 2008

Dry Tortugas Region--2010



Florida Keys Region--2010



Designing Marine Reserves for Fishery Management

Geoffrey A. Meester

Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, University of Miami,
Miami, Florida 33149, gmeester@rsmas.miami.edu

Anuj Mehrotra

Department of Management Science, School of Business Administration, University of Miami,
Coral Gables, Florida 33124, anuj@miami.edu

Jerald S. Ault

Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, University of Miami,
Miami, Florida 33149, ault@rsmas.miami.edu

Edward K. Baker

Department of Management Science, School of Business Administration, University of Miami,
Coral Gables, Florida 33124, ebaker@miami.edu

Optimal Design of Marine Reserves

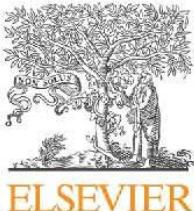
OBJECTIVE FUNCTION

$$\text{Min} \left\{ \mu_q^+ q^+ + \sum_{s \in S} (\mu_s^+ p_s^+ + \mu_s^- p_s^-) + (\mu_f^+ f^+ + \mu_f^- f^-) + (\mu_c^+ c^+ + \mu_c^- c^-) + (\mu_a^+ a^+ + \mu_a^- a^-) + \sum_{r \in R} (\mu_{ar}^+ a_r^+ + \mu_{ar}^- a_r^-) \right\}$$

Reserve shape	SPR over all species	fishing effort	Reef area	Total Reserve area	Regional Reserve area
---------------	----------------------	----------------	-----------	--------------------	-----------------------

CONSTRAINTS -- SUBJECT TO:

- (C1) Reserves non-overlapping
- (C2) Pre-specified number of reserves
- (C3) Fixed proportion of SPR protected
- (C4) Maximum number of fishing vessels displaced by reserves
- (C5) Target area of coral reef area protected
- (C6) Target total area protected
- (C7) Distribution of reserves among regions of ecosystem
- (C8) Each reserve contiguous, compact, and desirably shaped



Contents lists available at SciVerse ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres



Assessing coral reef fish population and community changes in response to marine reserves in the Dry Tortugas, Florida, USA

Jerald S. Ault^{a,*}, Steven G. Smith^a, James A. Bohnsack^b, Jiangang Luo^a, Natalia Zurcher^a, David B. McClellan^b, Tracy A. Ziegler^g, David E. Hallac^d, Matt Patterson^e, Michael W. Feeley^e, Benjamin I. Ruttenberg^b, John Hunt^f, Dan Kimball^c, Billy Causey^g

^a University of Miami Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, FL 33149, United States

^b NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149, United States

^c National Park Service, Everglades/Dry Tortugas National Park, 40001 State Road 9336, Homestead, FL 33034-6733, United States

^d Yellowstone Center for Resources, P.O. Box 168, Yellowstone National Park, WY 82190, United States

^e National Park Service, South Florida-Caribbean Network, 18001 Old Cutler Road Suite 419, Palmetto Bay, FL 33157, United States

^f Florida Fish and Wildlife Conservation Commission, 2796 Overseas Highway, Suite 119, Marathon, FL 33050, United States

^g Florida Keys National Marine Sanctuary, 33 East Quay Road, Key West, FL 33040, United States

(A)

Spatial Impact of Reserve Implementation

W
S

Bank ER
Density = 0.04
Occupancy = 5.3%

Park
Density = 0.10
Occupancy = 10.7%

Bank Open
Density = 0.19
Occupancy = 21.9%

24°45'0"N
24°40'0"N
24°35'0"N

24°45'0"N

24°40'0"N
24°35'0"N

24°30'0"N

24°30'0"N

83°5'0"W

83°0'0"W

82°55'0"W

82°50'0"W

82°45'0"W

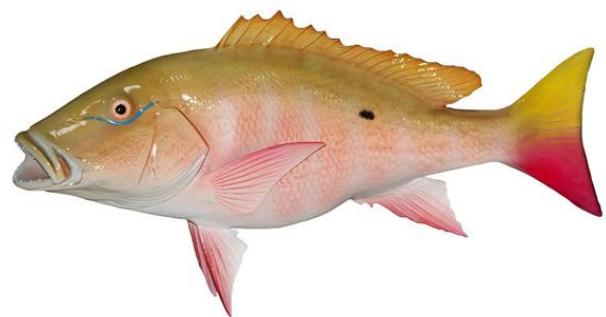
J'W 82°55'0"W 82°50'0"W 82°45'0"W

2000

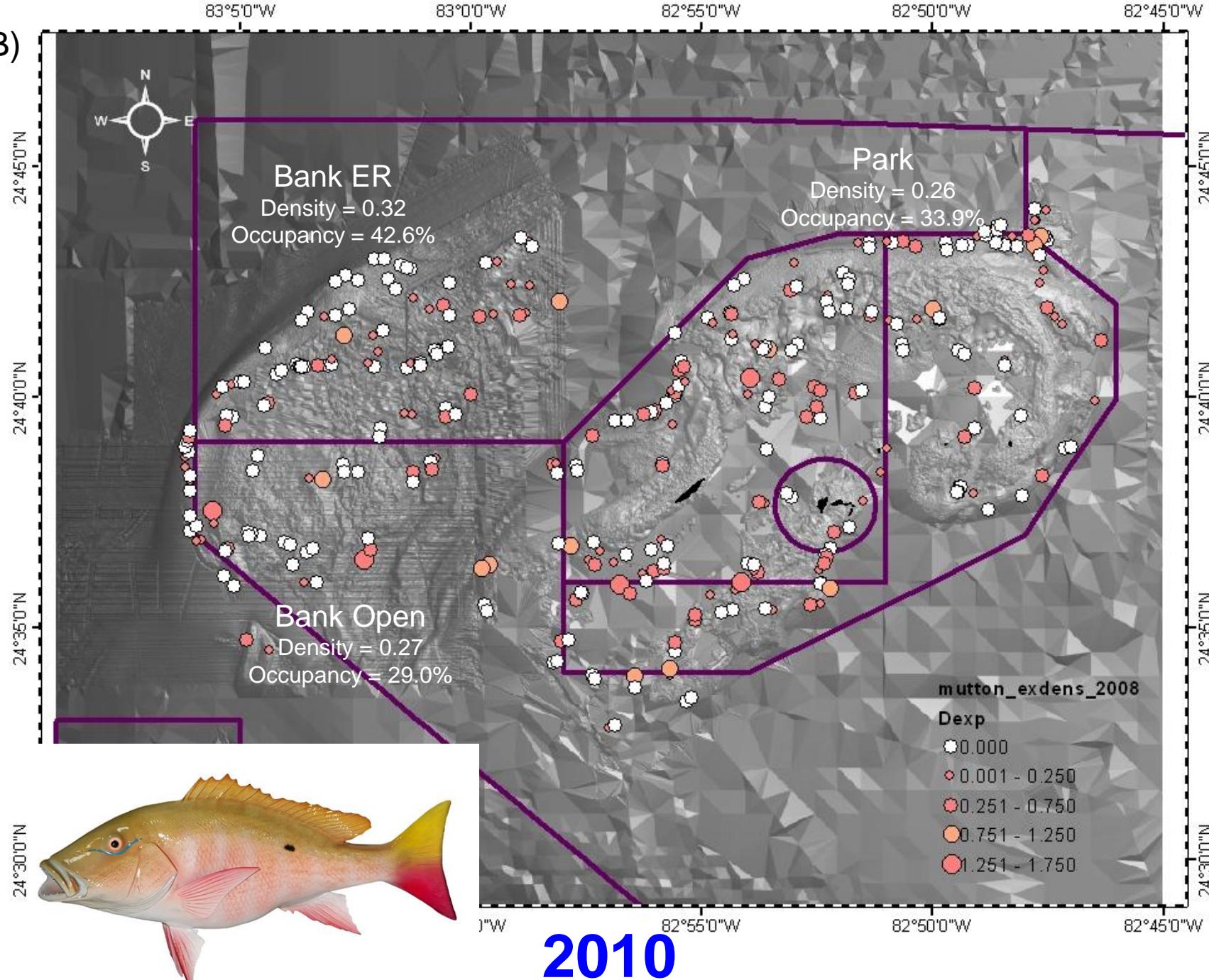
mutton_exdens_2000

Dexp

- 0.000
- 0.001 - 0.250
- 0.251 - 0.750
- 0.751 - 1.250
- 1.251 - 1.750



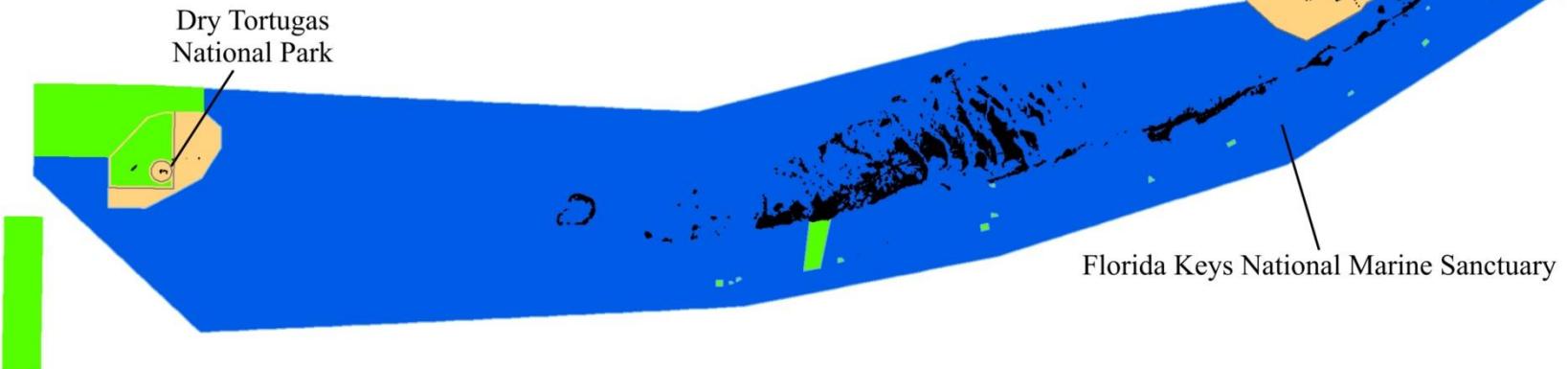
(B)

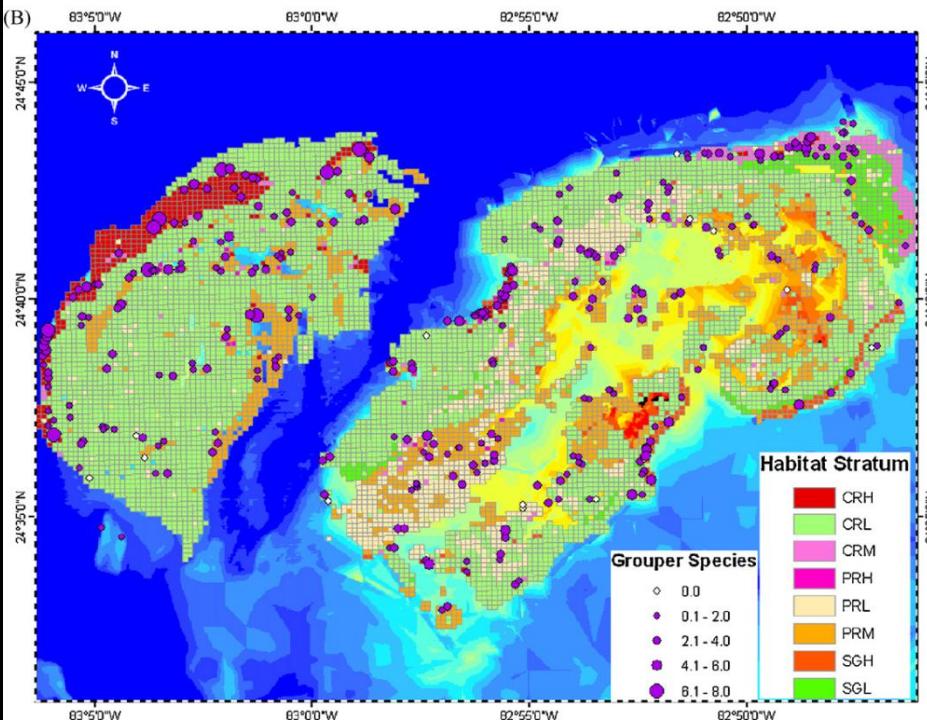
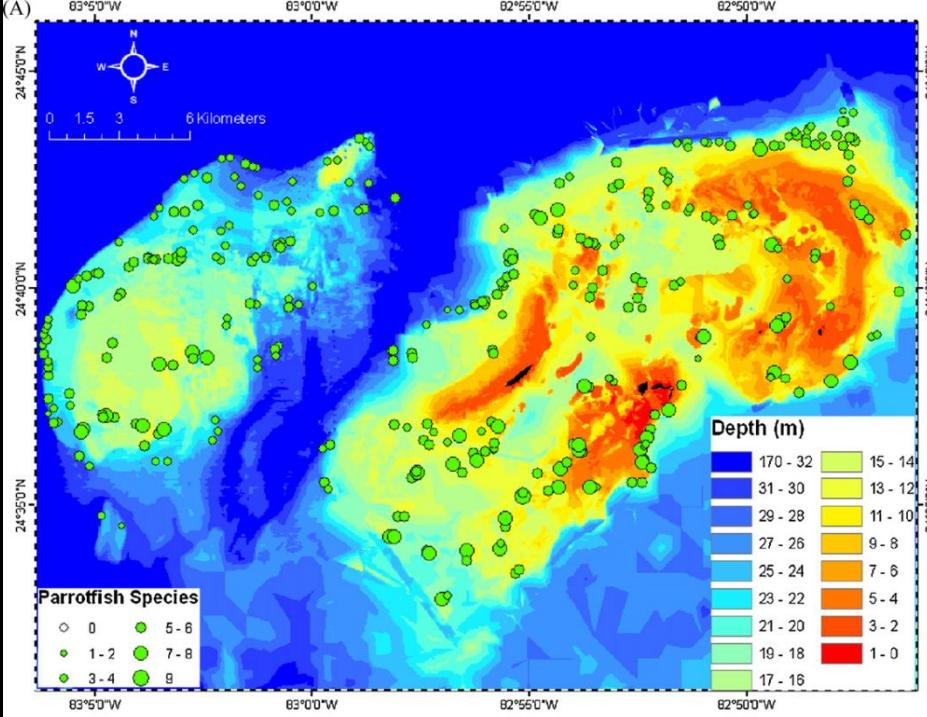


Dry Tortugas National Park:
22% of Survey Frame

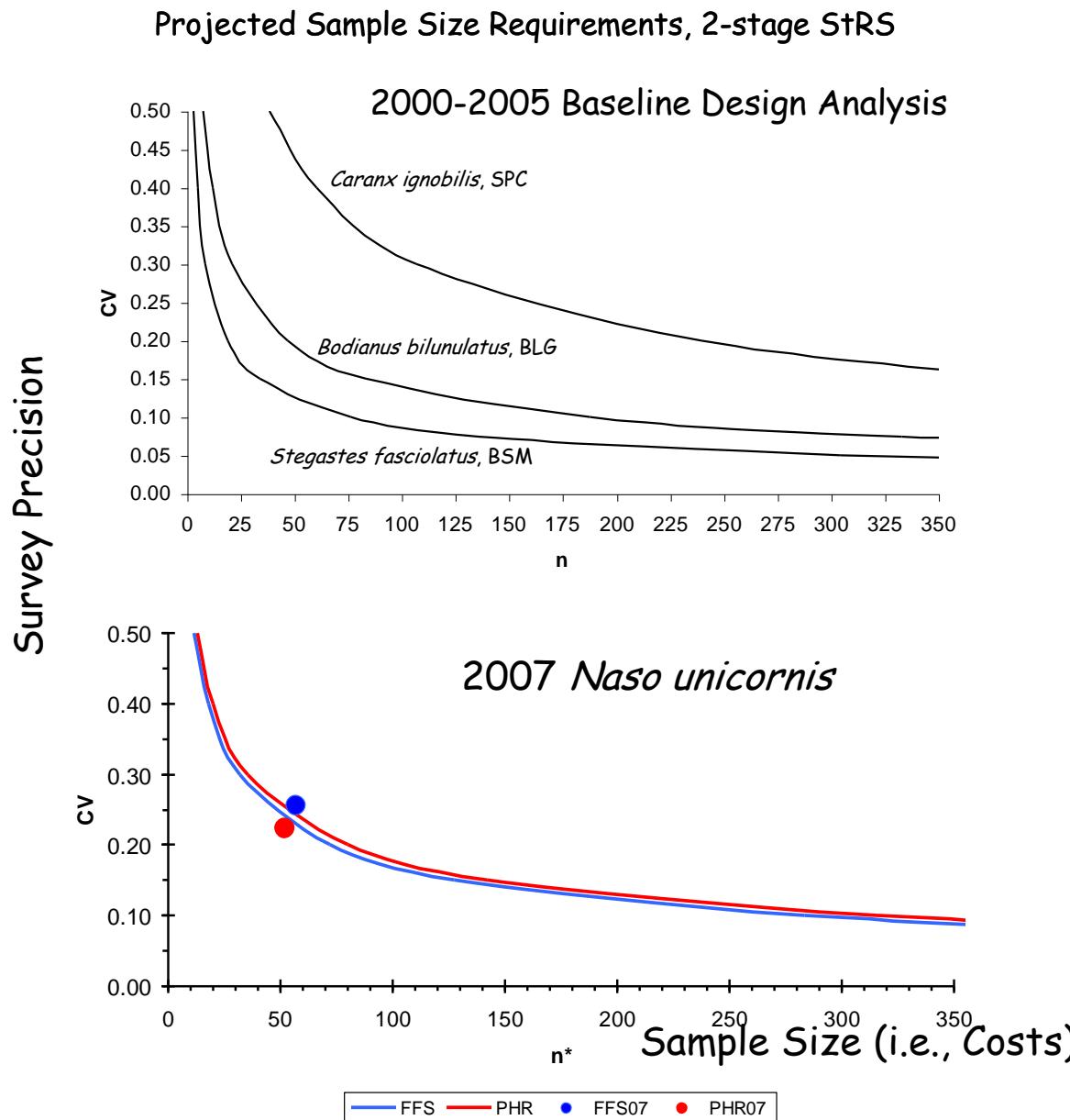
Contains 33 - 50% of adult spawner abundance for black and red grouper; yellowtail & mutton snapper.

These species are 55.5% of commercial reef fish catch in the State of Florida!!





Investigating Design Performance in Hawaii



We Thank You!

